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A NEW FIRE- AND EXPLOSION-PROOF LUBRICANT FOR GLASS-SHAPING MOLDS

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Compositions and properties of a new lubricant for glass-shaping molds and glass-molding machines are given. Its advantages over existing lubricants based on colloidal-graphite mixtures are shown.

Researchers continuously investigate the problem of fire- and explosion-proof lubricants for glass-shaping molds and drop-conducting chutes. A lubricant should also be hygienic, be resistant to oxidation, not cause burn-in on the molds, be easily deposited, and have a low coefficient of friction against glass.

Various lubricant compositions have been developed based on mineral oil or organic compounds (polymers). One of the most common lubricant varieties in Russia and abroad is colloidal-graphite lubricant based on mineral oil with various additives. Such lubricants contain a high-temperature lubricating material, a filler, which is usually graphite, and a stabilizing additive based on grade A and B paraffins and grade K rosin.

A lubricant commonly used in domestic factories is colloidal-graphite lubricant MS (GOST 608-430–74), which is a concentrated suspension in I-20 oil stabilized by semiasphalt and is produced by the Voskresenskii Chemical Works or the Kirovogradgrafit Zaval'evskii Works. The lubricants most frequently used abroad are produced by Cofral (France), Clinmold (USA), and Graforel (Germany).

Along with their positive properties, colloidal-graphite lubricants have significant disadvantages: their oil base burns out rapidly due to a low fire resistance, which increases gas pollution at workplaces and creates explosion and fire hazards in workshops, contaminates glass-shaping molds, and increases the oil vapor content in the atmosphere of production facilities. It is known that in the course of glass molding, a residue consisting of iron oxides and products of lubricant decomposition is formed on the inner surfaces of metallic molds. This degrades the quality of finished articles. The use of polymers as components in lubricants for glass-shaping molds (8 – 10%) virtually has not produced any benefit while increasing the environmental pollution through its decomposition products. Moreover, such lubricants have to be brought from outside, since they cannot be prepared on site.

All this motivated a search for ways to eliminate the reasons for the fire and explosion hazards of the lubricants, the environmental pollution, and the formation of a residue on the surface of glass-shaping molds.

In order to solve the indicated problem, the authors introduced an inorganic filler, namely, powder of heat-treated water glass, into existing lubricant compositions, instead of combustible fillers (graphite). Use of this powder makes it possible to raise the ignition temperature of the oil (from 175 – 190 to 600 – 650°C) and impart the properties of organosilicon compounds to lubricants based on mineral oil.

The main properties of the additive (filler) include fire resistance, volume weight, chemical resistance, and certain technological factors. The additive produced by heat treatment of water glass, which is a product of silicate-lump hydrolysis with a silicate modulus $2.5 \le \xi \le 3.5$, has a low volume weight (0.025 g/cm^3), is not combustible in a wide temperature range (its melting point is above 1100°C), and is chemically inert to the metals of glass-shaping molds and to the oil. The first factor makes it possible to develop a lubricant based on mineral oil in the form of a suspension, which does not separate in service. The second factor ensures chemical inertness to the oil medium at normal temperature and activity at high temperatures with formation of an organosilicon skeleton. This decreases the volatility of the lubricant based on mineral oil and, accordingly, reduces its consumption.

The following scheme of lubricant preparation is proposed. Water glass (GOST 13078–81) is heat-treated in stan-

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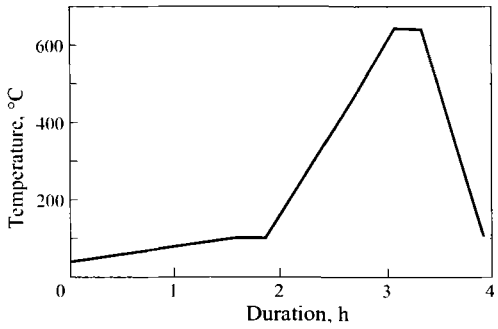

Fig. 1. Heat-treatment plot for water glass.

dard thermal units, in particular, annealing furnaces can be used in glass factories. The water glass is poured into metallic trays (1000 × 500 × 30 mm) to a height of 20 mm. Next the trays are placed in the thermal unit and heat-treated in accordance with the plot shown in Fig. 1.

The resulting swollen material is pulverized and sifted through a No. 005 sieve. Next, the powder is added to mineral oil with stabilizing additives (paraffin and rosin). Table 1 shows the compositions and parameters of lubricants based on I-20A mineral oil with a density of 0.9 g/cm^3 and an ignition temperature of 175°C. The stabilizing additives are petroleum paraffin and pinewood rosin of grade K.

It was found that at a temperature below 195°C lubricant 3 does not change its viscosity or fluidity for a long time. Lubricants 1 and 2 have high ignition temperatures. No burn-in was found on the molds in all cases.

The lubricant can be prepared using domestically produced industrial equipment or equipment assembled on site. The design of the tank for lubricant preparation developed by us was described earlier [1].

TABLE 1

Lubricant	Mass content, %			Density, g/cm^3, at temperature 70°C	Ignition temperature, °C
	mineral oil	water-glass powder	paraffin		
1	80	10	10	0.96	243
2	86	8	6	1.16	250
3	89	6	5	1.01	Not

First, mineral oil with stabilizing additives is poured into the tank, then the heating and bubbling systems are switched on, and the whole mixture is thoroughly stirred at 100 – 150°C. Monitoring of viscosity and density is constantly carried out. Then the filler, i.e., powder of heat-treated water glass, is added.

The filler is introduced not uniformly but in batches, from the minimum quantity to the maximum. Here the temperature in the tank is increased to 300 – 400°C. The mixture is thoroughly stirred to obtain a homogenous suspension.

The viscosity, density, and ignition point of the suspension are monitored. The ignition temperature is determined in an open crucible using the standard method.

In using the proposed lubricant, the molds are freed of residue and acquire clean surfaces.

The lubricant has been accepted for introduction at the Leninskii Glass Works.

REFERENCES

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